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Validation Report Lanes Training

J. W. Keesling
BDM Federal, Inc.

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13. ABSTRACT *(Maximum 200 words)*

The purpose of this report is to document the selection of course content and the Beta testing performed on the CBI modules developed to instruct personnel in the FSB companies. The report documents the performance gains (on computer-based tests) attained by the test subjects, and discusses some of the characteristics of the lessons that appear to be related to their relative effectiveness.

BDM Federal, Inc. was contracted by the Advanced Research Projects Agency and the Army National Guard to develop a series of computer-based courses to instruct soldiers in the supply, maintenance, and medical companies of the Forward Support Battalion (FSB). FSB Training Lanes were used to identify the critical skills that could be taught best by application of computer-based instruction (CBI). Subject-matter experts and instructional designers examined the content and sequencing to determine if they were appropriate on a a-priori grounds. This was followed by a phase of 'Alpha testing' in which the developers performed a trial-run of the lessons. Finally, a phase of 'Beta testing' used real subjects to determine the extent of learning.

14. SUBJECT TERMS
Training Lanes, Maintenance Training Lanes, Alpha testing, Beta testing, CBI lessons, (FSB) Forward Support Battalion, (ARPA) Advanced Research Projects Agency, (ARNG) Army National Guard

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VALIDATION REPORT LANES TRAINING

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VALIDATION REPORT LANES TRAINING

CONTENTS

LIST OF TABLES

LIST OF APPENDICES

VALIDATION REPORT LANES TRAINING

INTRODUCTION

Background

The Advanced Research Projects Agency (ARPA) and the Army National Guard (ARNG) contracted with BDM Federal, Inc. to develop a series of computer-based courses to instruct soldiers in the supply, maintenance and medical companies of the Forward Support Battalion (FSB). ARNG subject-matter experts developed the concept of FSB Training Lanes which they used to identify the critical skills that could be taught best by application of computer-based instruction (CBI). The use of the lanes training concept to identify the course content is described in a subsequent section of this report. The development of CBI for this content is described in detail by Deterline (1995).

All CBI courses developed for the FSB were subject to a formative evaluation. Bloom, Hastings and Madaus (*Handbook on Formative and Summative Evaluation of Student Learning*, New York: McGraw-Hill, 1971) describe formative evaluation of a curriculum in this way:

> . . . formative evaluation involves the collection of appropriate evidence during the construction and trying out of a new curriculum in such a way that revisions of the curriculum can be based on the evidence. (p. 117)

In the development of the FSB courses, formative evaluation began in the design phase. Subject-matter experts and instructional designers examined the content and sequencing to determine if they were appropriate on a-priori grounds. This internal quality control process was followed by a phase of 'Alpha testing' in which the developers performed a trial-run of the lesson to determine if the courseware tracked with the storyboards, and to identify flaws in the logic of presentation and errors or ambiguities in the instructions for navigation through the course. Finally, a phase of 'Beta testing' used real subjects drawn from the pool of target users to determine if they could navigate through the course successfully and the extent to which they learned from the material.

Purpose

This report documents the selection of course content and the Beta testing performed on the CBI modules developed to instruct personnel in the FSB companies. The report documents the performance gains (on computer-based tests) attained by the test subjects, and discusses some of the characteristics of the lessons that appear to be related to their relative effectiveness.

IDENTIFICATION OF TRAINING CONTENT

Lanes Training Concept

The Iowa National Guard has developed the lanes training concept for application to the supply, maintenance, and medical companies of the FSB. The lanes training concept is borrowed from the idea of the training lane used by the combat arms. A training lane for a combat arms unit involves a physical lane on the ground through which the combat vehicles pass while being subjected to various threats that they must react to and defeat. The lanes training concept applied to an FSB company consists of identifying critical collective tasks performed during an interval of time and arranging these tasks into a 'lane' consisting of a series of 'training stations' that takes the unit from the beginning to the end. The critical collective tasks are identified by examining the Mission Essential Task List (METL) of a particular FSB company.

First applied to the Maintenance Company, the Iowa National Guard laid out training stations supporting a training lane in such a way that the equipment, personnel, and time requirements for each station were fully specified. Since the entire training lane would normally require more than one weekend of training time, modularization of the training lane into training stations allowed the personnel being trained to work on the training stations over a sequence of weekends. This notion of modularization was carried forward into the CBI versions of the training lanes.

Identification of Training Lanes

ARPA requested that the Iowa National Guard provide subject matter experts (SMEs) to assist in the identification of appropriate training lanes for the supply, maintenance, and medical companies of the FSB. These SMEs performed a front-end analysis that resulted in identifying two potential training lanes for each of these companies. In addition, data from the National Training Center (NTC) indicated that the FSB companies were all experiencing difficulties in establishing defensive positions. Consequently, a common Defend Company Area training lane was developed. Ultimately, one of the possible lanes specific to each company was selected for further development. Table 1 indicates which collective task was chosen for each company.

Table 1: Company-Specific Collective Tasks Selected for Development

Company	METL Task	Selected Supporting Collective Task (Training Lane)
Supply	Request, Receive, and Issue Supplies	Provide Class III (Bulk) Supplies
Maintenance	Conduct Direct Support Maintenance and Repair Parts Supply Service Operations	Provide On Site Maintenance
Medical	Perform Health Service Support Operations	Provide Ground Ambulance Evacuation Support

Table 2: Training Lanes and Lessons for CBI Development

Training Lane Lesson Name	Number of Beta Tests
PROVIDE CLASS III (BULK) SUPPLIES	
A1 Supervise Receipt/Storage of POL Products	3
A2 Inspection of POL Products	2
A3 Direct POL Environment/Security Controls	2
A4 Tanker Operation and Safety	2
A5 Tank Trailer Operations	1
PROVIDE ON SITE MAINTENANCE	
B1 Inspect/Troubleshoot Track Vehicle Auto Systems	1
B2 Repair Diesel Power Pack	5
B3 Troubleshoot/Repair Radio Sets	3
B4 Repair Traversing Systems	3
B5 Repair BFV TOW2 ISU	3
B6 Organize and Dispatch Maintenance Support Team	3
B7 Supervise/Perform BDAR	2
PROVIDE GROUND AMBULANCE EVACUATION SUPPORT	
C1 Control Bleeding	4
C2 Triage/Survey Patients	4
C3 Plan for Evacuation	2
C4 Treating Respiratory Dysfunction	1
C5 General Casualty Management	3
C6 Treatment of Wounds	3
DEFEND COMPANY AREA	
D1 Terrain Analysis	2
D2 Commander: Plan Sector Defense	6
D3 Commander: Prepare Support Plans	4
D4 Commander: Prepare for Engagement	3
D5 Company: Prepare for Engagement	2
D6 Commander: Organize Hasty Defense/Disengagement	3
D7 Company: Conduct Hasty Defense/Disengagement	3

ARPA directed the SMEs supporting this project to identify specific skills/tasks within each lane that would be useful to have in CBI format. The guidance was to choose tasks that are difficult to teach in the Armory and that multimedia CBI should be able to instruct. The goal was to supply multimedia instruction that would be an effective substitute for initial levels of hands-on instruction. Table 2 displays the final set of training lanes and CBI lessons for this project.

The CBI lessons are components of each training lane. To conduct the entire lane the training manager must employ text-based, CBI, and hands-on instruction. Additional materials providing guidance to training managers about implementing the entire lane have been developed (see references under ARPA/Iowa National Guard). The CBI lessons are a critical component of these lanes. For the lane to function properly, the CBI must provide the students an opportunity to acquire the skills well enough that he or she will be prepared to master them in the limited number of hands-on experiences that can be provided. Without extensive testing, it is difficult to establish the exact degree of mastery required in the CBI environment to facilitate transfer of training to the real world. One purpose of the Beta testing conducted as part of the formative evaluation of the CBI lessons was to establish the degree to which students appeared to learn from the CBI. As further experience is gathered on the performance of students in the subsequent hands-on sections of the complete lanes, then some inferences can be made about how well the CBI training transfers to the real world.

ANALYSIS OF BETA TEST DATA

Data

Appendix A lists the data available for this validation study. Originally, it was hoped that there would be at least three subjects tested for each of the lessons. Unfortunately, there were not sufficient numbers of personnel in appropriate MOS designations available in the geographic region where the CBI was developed. Of the 25 lessons, 15 (60%) had three or more test subjects, while 7 other lessons had two test subjects, and 3 had only one test subject.

A total of 74 beta tests were performed in this validation. For each beta test, the student went through a pretest -- lesson -- posttest sequence. Typically, they went through this sequence in one sitting (sometimes interrupted for a meal break).

The instruction is designed to increase the student's knowledge of the subject matter, and to increase the number of subjects who are able to master the content of the lessons. To examine the degree to which the lessons were effective, we analyzed two types of performance measures: the percentage correct at pretest and posttest, and the attainment of mastery at pretest and posttest. For the purpose of this study, mastery is defined as attaining a score of 80 percent or higher on the proficiency test.

The CBI allows for the possibility that a person taking the lesson will have already

mastered some components of the instruction (called topics). Students who show mastery of topics at the time of the pretest are not required to take either the instruction or the posttest on that topic. However, during the beta testing some of the subjects were encouraged to take the instruction and all items on the posttest so that the development team could be sure that the navigation through these sections was correct and unambiguous. In scoring these results, a rule was imposed that if a person was allowed to skip the posttest in a particular topic, he or she was credited with the pretest score on those topics (usually 100%). Thus, the posttest scores and percentages reported here are based on the assumption that a student who knew the material at the beginning of the lesson will not have forgotten the material (or have been confused by the instruction) by the end of the lesson.

Interviews were conducted after the testing. In addition to eliciting general comments, these interviews focused on two important characteristics of the lessons: the degree to which the subjects understood the instructions about what to do next, and the appropriateness of the level of vocabulary. Another important characteristic of the lessons, the time it takes to complete the material (including testing before and after the instruction), was recorded as the subjects went through the lesson. In the following analyses, these characteristics of the lessons are related to the performance of the students.

Analysis

Some of the students who participated in the Beta testing were already relatively expert in the content of the lessons. They were chosen to perform a particularly careful review of the content. Altogether, there were 8 instances in which a student was able to attain the nominal mastery level (80 percent or higher correct) on the pretest: two students attained this level on one of the Maintenance lessons, and six other instances occurred on lessons in the Defend Company Sector lane. No student who showed mastery at the time of the pretest declined to a level below mastery at the time of the posttest. The two pretest masters in Maintenance had a pretest average of 86.5 percent correct and a posttest average of 89.5 on the lesson they had mastered. The six tests with mastery scores on lessons in Defend Company Sector averaged 83.7 percent correct on pretest and 96.7 percent correct on the posttest. The following discussion concerns only those beta tests where the students did not attain mastery at the pretest[1].

Table 3 illustrates two ways of examining the degree to which the lessons within a lane were effective in instructing the test students: increasing knowledge of subject matter and percentage attaining mastery. Students who were not masters at the time of the pretest learned a considerable amount from the lessons. Scores of non-masters averaged about 58 percent correct before instruction and about 84 percent correct after instruction. Students in all lanes made considerable gains from taking the lessons.

Table 3 also shows that for the Supply, Medical and Defend Company Sector lanes large percentages (at least 76 percent) of the students who were not masters at the pretest had

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[1] The posttest scores were not recorded for four students, so results are based on 62 tests.

attained that level by the time they completed the lesson and took the posttest. The Maintenance lessons are notably different in this regard, with only 33 percent of the non-masters moving to mastery.

Table 3: Average Pretest and Posttest Scores (for non-masters at pretest), by Training Lane

Training Lane	Average Pretest Score	Average Posttest Score	Percent of Masters at Posttest	Number of Beta Tests
Supply	54.1	82.7	80.0	10
Maintenance	50.5	75.4	33.3	18
Medical	63.2	87.5	76.5	17
Defend Company Sector	62.4	90.0	88.2	17
Total	57.8	83.9	67.7	62

Table 4 shows that a very high percentage of the students taking these lessons reported that the level of vocabulary was appropriate. However, the lessons differed in the clarity of the directions in the CBI. The Medical lane CBI had the lowest proportion of students reporting that the instructions were clear. Generally, however, this lack of clarity did not seem to affect the attainment of the students. Analysis of their comments indicated that they were reporting that some sequences required considerably more attention than others to determine what they were supposed to do next. This might be a characteristic to reexamine if it becomes necessary to rewrite these lessons because of changes to doctrine or equipment. Clarity of the instructions was above average for the lessons in the Maintenance lane, so this does not account for the difference in attainment of mastery.

Table 4: Appropriateness of Vocabulary and Clarity of Instructions, by Training Lane

Training Lane	Percent Reporting Vocabulary was Appropriate	Percent Reporting Instructions were Clear	Number of Beta Tests
Supply	100.0	60.0	10
Maintenance	94.1	64.7	17
Medical	87.5	43.8	16
Defend Company Sector	100.0	75.0	16
Total	94.9	61.0	59

Table 5 shows that the lanes differed considerably in the length of time required to go through the lessons. Lessons in the Maintenance lane averaged nearly 1.5 hours in length (almost 2.0 hours including testing), while those in the other lanes averaged less than one hour (about 1.25 hours, with testing). Table 5 also indicates that the students taking the Maintenance lane knew less of the material initially. These characteristics may be important

in determining the rate at which the Maintenance lane lessons produced mastery by the time of the posttest.

Table 5: Minutes Required to Take One Lesson, by Training Lane

Training Lane	Minutes to complete lesson and testing	Minutes to complete lesson alone	Number of Beta Tests
Supply	73.8 (25.3)	51.4 (18.9)	10
Maintenance	119.2 (47.6)	89.3 (38.4)	18
Medical	79.5 (29.9)	53.2 (22.2)	17
Defend Company Sector	75.8 (40.8)	45.8 (21.7)	16
Total	89.3 (42.2)	61.6 (32.5)	61

Table note: Numbers in parentheses are standard deviations.

Table 6 examines the individual lessons within the Maintenance lane in more detail. It shows the length time required to take the lessons, the average pretest and posttest scores on the lanes, and the proportion of non-masters who attained mastery. This table indicates that three of the lessons in this lane (B3, B5, B6) were somewhat like the typical lessons in the other lanes: average pretest scores were above 60 percent correct, and the lessons took 1.0-1.5 hours to complete (including testing). Seventy-one percent of the students who were initially non-masters attained mastery after taking these lessons. This is a somewhat lower rate than that for the other lanes.

Table 6: Detail on Lessons in the Maintenance Training Lane

Lesson	Minutes to Complete Lesson and Testing	Minutes to Complete Lesson Alone	Average Pretest Score	Average Posttest Score	Percent of Masters (Posttest)	Number of Beta Tests
B1	180.0 (0.0)	140.0 (0.0)	47.0	67.0	0.0	1
B2	158.4 (15.0)	115.6 (11.4)	40.0	67.4	0.0	5
B3	91.0 (24.3)	71.7 (20.8)	68.3	86.0	66.7	3
B4	156.7 (10.4)	123.3 (11.5)	31.0	68.7	0.0	3
B5	78.0 (0.0)	62.0 (0.0)	74.0	84.0	100.0	1
B6	78.0 (45.9)	56.0 (42.2)	68.3	83.3	66.7	3
B7	59.0 (8.5)	37.5 (4.9)	42.5	77.5	50.0	2

Table note: Numbers in parentheses are standard deviations.

One lesson (B7) had low pretest scores, but could be completed in a relatively short time. Half of the students who had not previously mastered this lesson were able to master it by taking the lesson. Students taking the other three lessons (B1, B2, B4) had very low average pretest scores and required very long times to complete the lessons (about 2 hours).

Perhaps the topics covered in these lessons are too unfamiliar to the students and the time required to assimilate this knowledge is simply too long to allow the students to move from non-mastery to mastery in a single session.

DISCUSSION

Generally speaking, the CBI lessons developed to train soldiers in the supply, maintenance and medical companies of the FSB are highly effective. Beta test results show that posttest scores are considerably higher than pretest scores and two-thirds of the students who were non-masters at the time of the pretest became masters after taking the lesson. Three lessons in the Maintenance lane were different from the others in that students began with very little knowledge of these topics, the lessons took very much longer to complete, and no students were able to master the material in these lessons. It may be that the length of the lessons inhibited the students from attaining mastery when they attempted to take the lesson in a single, extended session. Because the CBI allows students to take the lessons topic-by-topic, students should be able to acquire mastery by pacing themselves through the lessons, rather than taking an entire long lesson at one sitting.

Table 7 is provided as additional guidance for training managers and students. It shows the average time required by the beta test students to take each lesson (including testing) and the average posttest score[2]. These figures can be used during instructional planning to determine whether a student will have the time to take a lesson, and to make a judgement about the proficiency to be gained by taking the lesson. Appendix C provides additional information on student attainment.

RECOMMENDATIONS

The CBI permits these lessons to be used in a modular fashion, and it may be wise to advise training managers and the students taking the lessons that if they are unfamiliar with the material at the start (evidenced by a pre-test score below 50 percent correct), or if the lesson is very long (more than 80 minutes), they should plan to take it in two or three sessions rather than attempt to complete it all at one sitting.

Appendix B indicates that the SMEs' original estimates of time required for these lessons is not accurate, so the actual times derived from the beta testing are provided for more accurate guidance about time required to complete each lesson.

Table 7: Time Required and Posttest Scores for CBI Lessons, by Training Lane

Training Lane Lesson Name	Total Minutes Required	Posttest Percent Correct
PROVIDE CLASS III (BULK) SUPPLIES		
A1 Supervise Receipt/Storage of POL Products	83	87
A2 Inspection of POL Products	78	75
A3 Direct POL Environment/Security Controls	53	85
A4 Tanker Operation and Safety	62	82
A5 Tank Trailer Operations	104	83
PROVIDE ON SITE MAINTENANCE		
B1 Inspect/Troubleshoot Track Vehicle Auto Systems	180	67
B2 Repair Diesel Power Pack	158	67
B3 Troubleshoot/Repair Radio Sets	91	86
B4 Repair Traversing Systems	157	69
B5 Repair BFV TOW2 ISU	78	84
B6 Organize and Dispatch Maintenance Support Team	78	83
B7 Supervise/Perform BDAR	59	77
PROVIDE GROUND AMBULANCE EVACUATION SUPPORT		
C1 Control Bleeding	46	94
C2 Triage/Survey Patients	103	82
C3 Plan for Evacuation	60	100
C4 Treating Respiratory Dysfunction	93	72
C5 General Casualty Management	103	88
C6 Treatment of Wounds	79	83
DEFEND COMPANY AREA		
D1 Terrain Analysis	70	90
D2 Commander: Plan Sector Defense	110	83
D3 Commander: Prepare Support Plans	92	88
D4 Commander: Prepare for Engagement	58	88
D5 Company: Prepare for Engagement	44	100
D6 Commander: Organize Hasty Defense/Disengagement	39	100
D7 Company: Conduct Hasty Defense/Disengagement	40	95

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APPENDIX A

LISTING OF DATA

ANALYSIS OF CBI BETA TEST RESULTS

Lesson Name	SUPERVISED TRIAL LESSON	TOOK TRIAL LESSON	RANK OF PERSON TAKING LESSON	MOS OF PERSON TAKING LESSON	PRETEST SCORE	POSTTEST SCORE	TIME FOR LESSON	TOTAL TIME FOR LESSON AND TESTING	Q3	Q4
A1	13	16	E-5	77F20	60.0	80.0	97.0	127.00	N	Y
	13	36	E-5	77F20	40.0	90.0	30.0	46.00	N	Y
	13	28	SFC	91B40	65.0	90.0	62.0	76.00	N	Y
A2	6	2	SPC	77F	55.0	80.0	50.0	74.00	Y	Y
	6	25	PFC	77F	55.0	70.0	51.0	81.00	Y	Y
A3	3	5	E-7	92Y	60.0	85.0	38.0	57.00	Y	Y
	3	17	E-5	31U	55.0	85.0	32.0	49.00	Y	Y
A4	6	.	.	.	65.0	88.0	50.0	65.00	Y	Y
	5	17	E-5	31U	59.0	76.0	49.0	59.00	N	Y
A5	4	25	PFC	77F	27.0	83.0	55.0	104.00	Y	Y
B1	12	46	SGT	63H	47.0	67.0	140.0	180.00	N	Y
B2	3	21	SGT	63H	62.0	76.0	120.0	152.00	Y	Y
	3	45	PV2	62B10	38.0	62.0	130.0	185.00	Y	Y
	3	10	SGT	52D20	19.0	52.0	103.0	150.00	Y	Y
	3	9	SGT	63H	24.0	71.0	120.0	155.00	.	.
	3	34	SPC4	63H	57.0	76.0	105.0	150.00	Y	Y
B3	1	4	E-6	29E	58.0	84.0	95.0	119.00	Y	Y
	12	15	SGT	29E	68.0	74.0	55.0	75.00	Y	Y
	12	30	E-4	29J	79.0	100.0	65.0	79.00	Y	Y

ANALYSIS OF CBI BETA TEST RESULTS

Lesson Name	SUPERVISED TRIAL LESSON	TOOK TRIAL LESSON	RANK OF PERSON TAKING LESSON	MOS OF PERSON TAKING LESSON	PRETEST SCORE	POSTTEST SCORE	TIME FOR LESSON	TOTAL TIME FOR LESSON AND TESTING	Q13	Q4
B4	3	14	E-7	45K	33.0	62.0	110.0	145.00	N	Y
	3	32	E-5	.	24.0	76.0	130.0	160.00	N	Y
	3	8	E-5	45K	36.0	68.0	130.0	165.00	Y	Y
B5	8	3	E-7	27B4H	89.0	84.0	128.0	156.00	Y	.
	8	6	SFC	27B	74.0	84.0	62.0	78.00	N	Y
	4	38	E-5	27E	84.0	95.0	43.0	68.00	N	Y
B6	11	18	1LT	91B	70.0	95.0	25.0	50.00	Y	Y
	9	29	2LT	91B	70.0	75.0	39.0	53.00	N	N
	9	43	1LT	91B00	65.0	80.0	104.0	131.00	Y	Y
B7	9	12	SSG	63H	55.0	85.0	34.0	53.00	Y	Y
	9	22	SGT	63H	30.0	70.0	41.0	65.00	N	Y
C1	10	1	SSG	91B	76.0	100.0	10.0	20.00	Y	Y
	10	13	SPC	91B	47.0	100.0	30.0	50.00	Y	Y
	13	19	SGT	91B	76.0	88.0	43.0	61.00	N	Y
	13	42	SPC	91B	50.0	86.0	34.0	51.00	N	Y
C2	10	1	SSG	91B	62.0	85.0	65.0	110.00	Y	Y
	13	13	SPC	91B	66.0	76.0	90.0	130.00	N	Y
	13	37	SPC	91B	70.0	91.0	72.0	107.00	N	Y
	13	7	SPC	91B	55.0	76.0	40.0	64.00	N	N
C3	10	44	1LT	67B	69.0	100.0	35.0	55.00	.	.
	10	41	1LT	67B	25.0	100.0	40.0	64.00	N	Y

ANALYSIS OF CBI BETA TEST RESULTS

Lesson Name	SUPERVISED TRIAL LESSON	TOOK TRIAL LESSON	RANK OF PERSON TAKING LESSON	MOS OF PERSON TAKING LESSON	PRETEST SCORE	POSTTEST SCORE	TIME FOR LESSON	TOTAL TIME FOR LESSON AND TESTING	Q3	Q4
C4	11	28	E-7	91B40	56.0	72.0	48.0	93.00	Y	Y
C5	13	35	MAJ	67R	73.0	84.0	94.0	124.00	Y	Y
	13	39	E-5	91B20	78.0	89.0	68.0	106.00	Y	Y
	13	20	E-5	91B	76.0	92.0	58.0	80.00	N	Y
C6	10	39	SGT	91B	74.0	84.0	48.0	66.00	N	Y
	10	20	SGT	91B	54.0	86.0	53.0	72.00	Y	Y
	13	28	SFC	91B40	68.0	78.0	76.0	98.00	N	N
D1	.	40	LTC	QM	72.0	88.0	45.0	70.00	Y	Y
	.	31	MAJ	91B00	76.0	92.0	45.0	70.00	.	.
D2	2	17	E-5	31U	48.0	76.0	95.0	165.00	N	Y
	2	24	E-6	92Y30	38.0	86.0	93.0	163.00	N	Y
	2	44	1LT	67B	71.0	81.0	43.0	70.00	Y	Y
	2	23	2LT	11AV	58.0	89.0	33.0	57.00	Y	Y
	2	28	SFC	91B	53.0	89.0	50.0	88.00	N	Y
	7	27	SSG	75Z30	79.0	79.0	60.0	117.00	Y	Y
D3	2	31	CPT	91B00	88.0	100.0	108.0	156.00	N	Y
	2	35	MAJ	67B	81.0	92.0	75.0	125.00	Y	Y
	2	33	1LT	11A	69.0	88.0	55.0	92.00	Y	Y
	2	26	CPT	25C	81.0	100.0	90.0	120.00	Y	Y
D4	.	35	MAJ	67B	59.0	88.0	40.0	59.00	N	Y
	2	33	1LT	11A	53.0	88.0	25.0	57.00	Y	Y
	2	11	CPT	11A00	82.0	88.0	21.0	33.00	Y	Y

ANALYSIS OF CBI BETA TEST RESULTS

Lesson Name	SUPERVISED TRIAL LESSON	TOOK TRIAL LESSON	RANK OF PERSON TAKING LESSON	MOS OF PERSON TAKING LESSON	PRETEST SCORE	POSTTEST SCORE	TIME FOR LESSON	TOTAL TIME FOR LESSON AND TESTING	Q3	Q4
D5	2	44	CPT	67B	69.0	100.0	33.0	44.00	Y	Y
	2	33	1LT	11A	85.0	100.0	39.0	51.00	N	Y
D6	3	35	MAJ	67B	77.0	100.0	.	.	Y	Y
	3	33	1LT	11A	54.0	100.0	26.0	39.00	Y	Y
	3	11	CPT	11A	85.0	100.0	25.0	40.00	Y	Y
D7	2	47	SSG	75D	78.0	100.0	20.0	34.00	Y	Y
	2	44	CPT	67B	50.0	100.0	32.0	41.00	Y	Y
	13	24	E-6	92Y	57.0	86.0	37.0	46.00	Y	Y

APPENDIX B

ESTIMATION OF TIME REQUIRED TO COMPLETE LESSONS

To make projections about the time that would be required to develop the CBI instruction, the SMEs estimated the amount of time that would be required for a student to take each lesson. These estimates were made prior to starting on the development of storyboards, when only the basic content of each lesson had been decided upon. The SMEs were not experienced in CBI development so they based their estimates on their experience with other forms of instruction.

Because the courses were developed to be used as modules, it is difficult to predict the time required for an individual student to take a lesson. A student may find, from the pretest, that he or she knows a lot about certain topics covered in a lesson and will be allowed to skip this instruction and the associated posttest. Other students will take all of the topics. When the SMEs developed their estimates, they assumed that students would take all of the modules. They did not explicitly include time to take pretests and posttests (which are integral components of the CBI instruction) in their estimates.

As development progressed, some lessons were shorter than anticipated, while others were longer. Some content was reorganized to facilitate instruction. The original lesson for Tanker Operation and Safety was split into a lesson of the same name and one on Tank Trailer Operations. The original lesson on Defend/Prepare for Level I, II, and III Threat/Attack was split into a lesson addressing the company commander and one addressing other company personnel. The original lessons Perform Withdrawal Under Fire and Conduct Hasty Displacement contained a mixture of tasks for leaders and other personnel and these were sorted out into two separate lessons. In Table B-1 the time (in minutes) projected for the aggregate of the lessons in each lane is contrasted with the actual total time required to complete the lessons and testing. Since some of the beta test students did not have to take all the topics and posttests (because they obtained high scores on topic pretests), the actual times underestimate the total amount of CBI developed in this project. Taking all lanes together, the actual time exceeds the estimate by 30 percent.

Table B-1: Estimated and Actual Time Required to Take CBI Courses and Tests

Training Lane	Estimated Time[a]	Actual Time[b]
Supply	345	380
Maintenance	570	800
Medical	480[c]	484[c]
Defend Company Area	240[c]	453[c]

[a] Estimated time (in minutes) is the sum of the times estimated for each lesson in the lane.
[b] Actual time (in minutes) is the sum of the average time required by beta test students on each lesson in the lane.
[c] Medical and Defend Company Area times do not include the collective lesson for each lane.

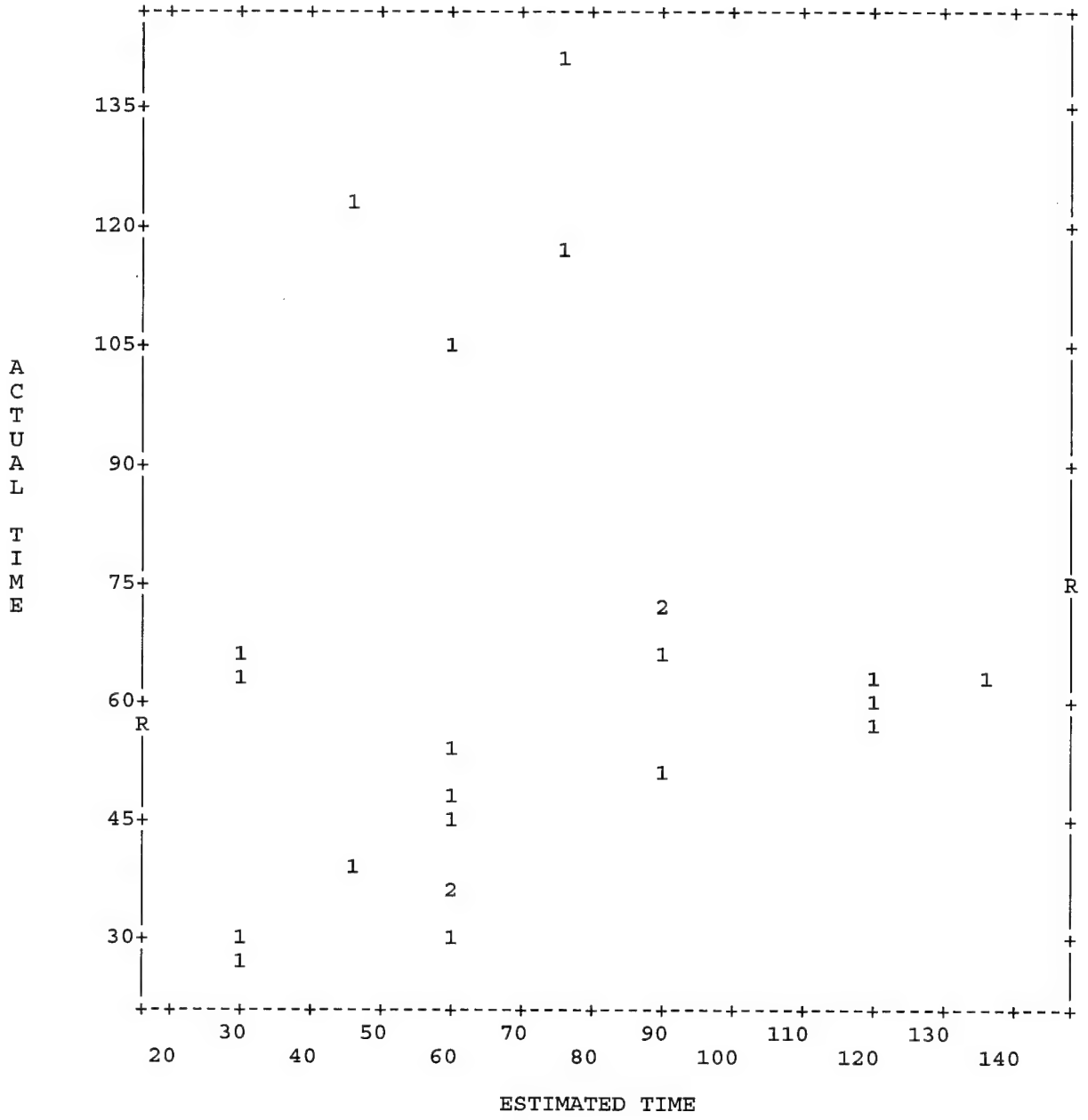
The next set of figures examines the accuracy of the SME estimates by relating the estimated time to the average actual time to complete each lesson. For the lessons that were split, the estimated time for the original lesson is related to the sum of the actual times for the two lessons. The estimated times for the two defend lessons that were reorganized were equal and it was assumed that the reorganization resulted in two lessons of equal length.

Figures B-1 shows the relationship between the estimated and the actual times to complete the lesson alone, while figure B-2 shows the relationship between the estimated and actual times to complete both the lesson and the testing. All times are given in minutes. The actual times are the average times required by the students who beta tested these lessons. The regression line for the relationship in each plot is defined by the endpoints marked with the letter 'R'. Both plots are characterized by having four very strong outliers -- values for which the actual time is much higher than the estimated time. These points tend to diminish the relationship between estimated and actual times, neither of which is statistically significant. This means that based on the entire set of data, the SMEs predictions about time requirements were not related to the actual times.

Figures B-3 and B-4 show that if the four strong outliers are removed, there is a substantial positive relationship between the SMEs' estimated times and the actual times required to complete these lessons (not including testing). The estimated time correlates .53 with the lesson time, but only .26 with the total time. The first of these correlations is statistically significant. These relationships indicate that (with a few exceptions -- the outliers) the SMEs were able to predict which lessons would take more time than others. They were, however, less able precisely to predict the total amount of time required to take the tests and the lessons. Thus, they underestimated the amount of CBI development that would be required for this project.

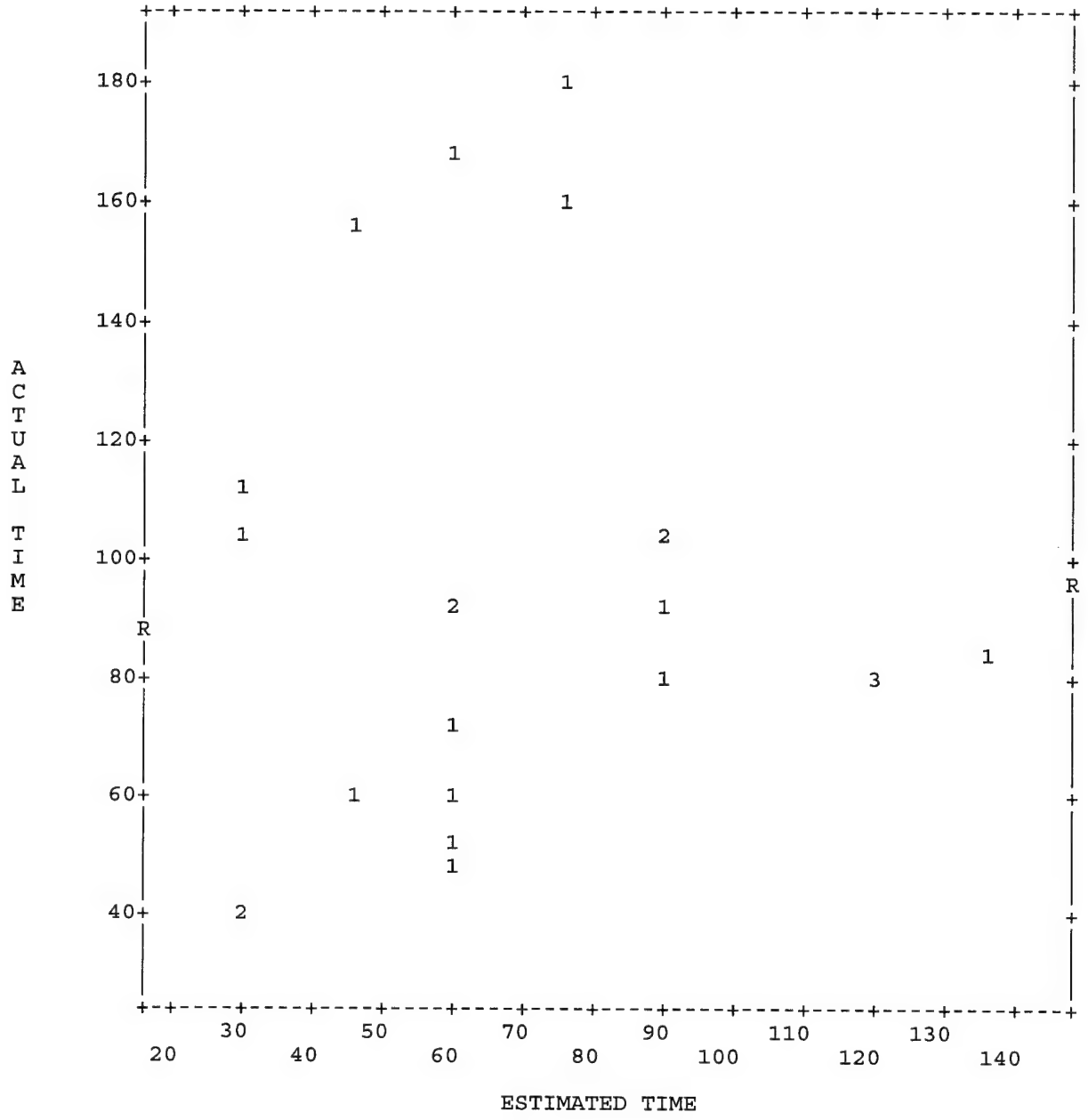
Because each student will come to a lesson with different preexisting knowledge of the subject matter, and because the lessons allow students who exhibit mastery at the time of the pretest to skip certain instruction and posttesting, it is very difficult to predict how much time an individual student will take. We recommend that training managers use the average actual times (see Table 7 in the main section of this document) as guidance, and be prepared with a contingency activity for students who finish more rapidly than these times predict. The modular nature of the instruction will allow a student who requires more time to complete some topics at one session and finish the rest at another session.

FIGURE B-1: ACTUAL AND ESTIMATED TIME TO TAKE LESSON (TESTING NOT INCLUDED)



23 cases plotted. Regression statistics:
Correlation .14173 R Squared .02009 S.E. of Est 31.12899 Sig. .5189
Intercept(S.E.) 53.40442(16.36494) Slope(S.E.) .13865(.21133)

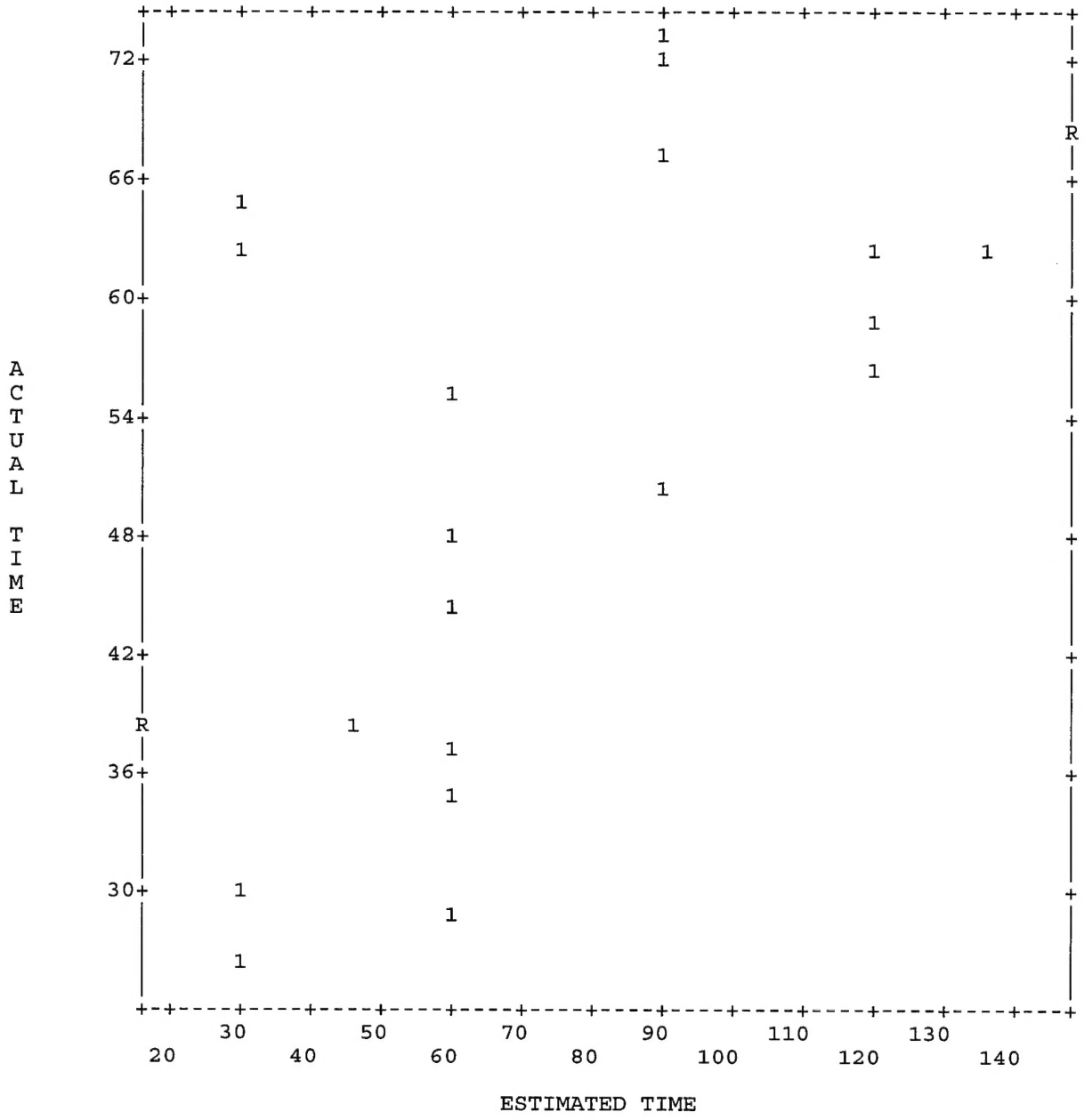
FIGURE B-2: ACTUAL AND ESTIMATED TIME TO TAKE LESSON (TESTING INCLUDED)



23 cases plotted. Regression statistics :

Correlation	.04325	R Squared	.00187	S.E. of Est	40.81798 Sig. .8446
Intercept(S.E.)	88.17899(21.45858)	Slope(S.E.)	.05497(.27710)		

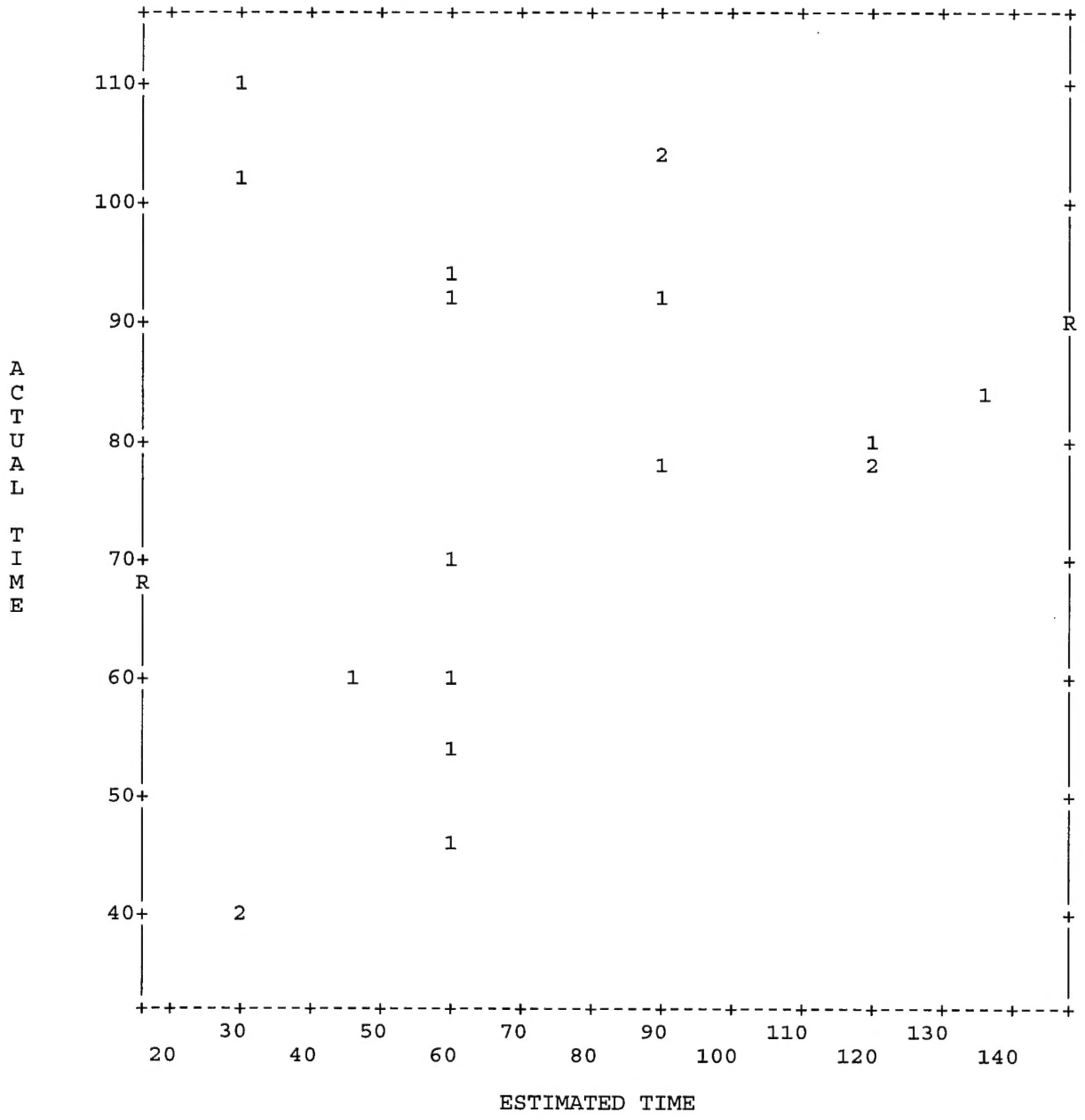
FIGURE B-3. ACTUAL AND ESTIMATED TIME TO TAKE LESSON (TESTING NOT INCLUDED)



19 cases plotted. Regression statistics:

Correlation	.52781	R Squared	.27858	S.E. of Est	13.16558 Sig. .0202
Intercept(S.E.)	34.17747(	7.28319)	Slope(S.E.)	.23379(	.09125)

FIGURE B-4. ACTUAL AND ESTIMATED TIME TO TAKE LESSON (TESTING INCLUDED)



19 cases plotted. Regression statistics:

Correlation	.26276	R Squared	.06905	S.E. of Est	21.94750 Sig. .2771
Intercept(S.E.)	64.27873	(12.14134)	Slope(S.E.)	.17080	(.15211)

APPENDIX C

MASTERY LEVELS ATTAINED BY NON-MASTERS AT PRETEST

This appendix gives training managers additional information about the attainment of students who take the CBI lessons for personnel in the FSB. In the body of this report, the criterion for mastery was set at 80 percent correct. The training manager may wish to use a different criterion. This appendix examines the attainment of students who scored less than 70 percent correct on the pretest. About 70 percent of the students who participated in the beta testing of these lessons attained scores in this range on the pretest. This level of performance is presumed to indicate that additional training in these areas is required. This appendix shows what percentage of these students (in need of instruction) attained each of several levels of mastery.

Table C-1 displays information about attainment for those students who attained less than 70 percent correct on the pretest for each lesson. For each of six levels of mastery attainment (70%, 75%, 80%, 85%, 90%, and 95% correct on the posttest), the percentage of the pretest non-masters who attained this level is indicated in the body of the table. Thus, 100 percent of the students who were non-masters at pretest on Defend Company Area lessons attained a score of 75 percent correct on the posttest. Only 27 percent of these students attained a score of 95 percent correct on the posttest. Figure C-1 displays this information graphically.

Table C-1: Percentage of Students in Each Lane Attaining Mastery, by Mastery Cut Score

		Mastery Level Cut Score					
Training Lane	N =	70%	75%	80%	85%	90%	95%
Defend Company Area	11	100	100	91	91	27	27
Medical	10	100	90	60	60	30	30
Supply	10	100	90	80	50	20	0
Maintenance	14	64	43	21	7	0	0

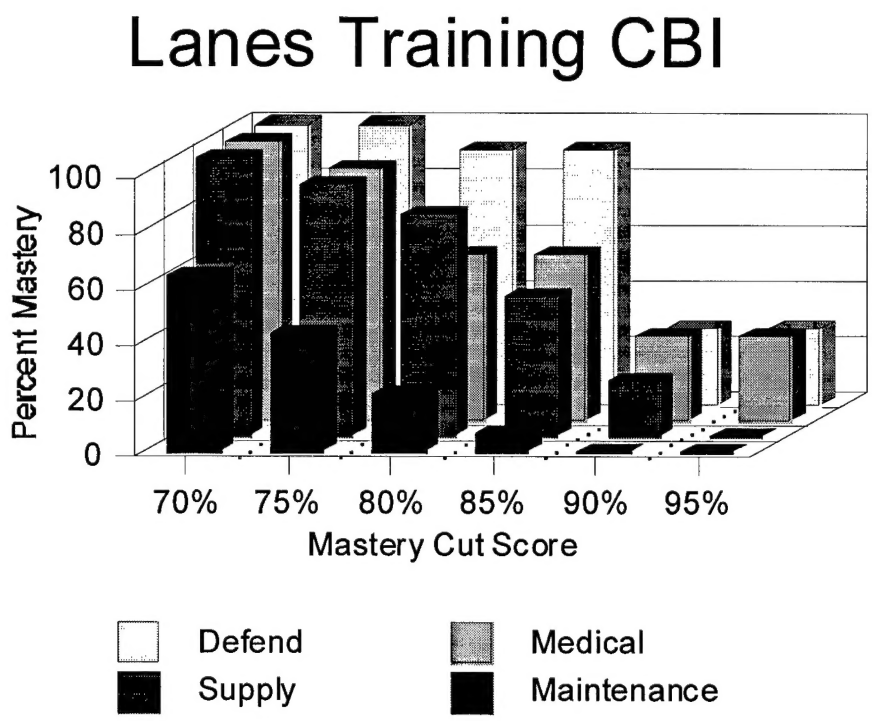


Figure C-1. Mastery level attainment for CBI lessons in each training lane, by mastery cut score.